



NASA STTR 2006 Phase I Solicitation

T7 Langley Research Center

In alliance with industry, other agencies, academia, and the atmospheric research community in the areas of aerospace vehicles, aerospace systems analysis, and atmospheric science, the Langley Research Center undertakes innovative, high-payoff activities beyond the risk limit or capability of commercial enterprises and delivers validated technology, scientific knowledge, and understanding of the Earth's atmosphere. Our success is measured by the extent to which our research results improve the quality of life of all Americans.

Subtopics

T7.01 Non-Destructive Evaluation and Structural Health Monitoring

Lead Center: LaRC

Center: LaRC

Innovative concepts are being solicited for the development of non-destructive evaluation (NDE) and health-monitoring technologies for vehicles and structures involved in exploration missions. The highest priority is structural health monitoring systems that provide real time in situ diagnostics and evaluation of structural integrity. Emphasis is focused on highly miniaturized, lightweight, compact systems that deliver accurate assessment of structural health. The sensors, data acquisition and analysis systems and associated electronics must perform in high stress and hostile conditions expected on launch vehicles and space environments. Diagnostic systems intended for external inspection of space vehicles and structures will be highly autonomous, remotely operated and preferably non-contacting.

Evaluation sciences include ultrasonics, laser ultrasonics, optics and fiber optics, video optics and laser metrology, thermography, electromagnetics, acoustic emission, X-ray and terahertz radiation. Innovative and novel evaluation approaches are sought for the following materials and structural systems:

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- Adhesives and bonded joints, sealants, bearings, coatings, glasses, alloys, laminates, monolithics, material blends, wire insulating materials, and weldments;
 - Thermal protection and insulation systems;
 - Complex composite and hybrid structural systems; and
 - Low-density and high-temperature materials.

Proposals should address the following performance metrics as appropriate:

- Characterization of material properties;
- Assessment of effects of defects in materials and structures;
- Evaluation of mass-loss in materials;
- Detection of cracks, porosity, foreign material, inclusions, and corrosion;
- Dis-bonded adhesive joints;
- Detection of cracks around fasteners such as bolts and rivets;
- Real-time and in situ monitoring, reporting, and damage characterization for structural durability and life prediction;
- Repair certification;
- Environmental sensing;
- Planetary entry aero-shell validation;
- Micro-meteor and orbital debris impact location and damage assessment;
- Electronic system/wiring integrity assessment;
- Wire insulation integrity and condition (useful life) and arc location for failed insulation;
- Characterization of load environment on a variety of structural materials and geometries including thermal protection systems and bonded configurations;
- Identification of loads exceeding design;
- Monitoring loads for fatigue and preventing overloads;
- Suppression of acoustic loads;
- Early detection of damage; and
- In situ monitoring and control of materials processing.

Measurement and analysis innovations will be characterized by:

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- Advanced integrated multi-functional sensor systems;
 - Autonomous inspection approaches;
 - Distributed/embedded sensors;
 - Roaming inspectors;
 - Shape adaptive sensors;
 - Concepts in computational models for signal processing and data interpretation to establish quantitative characterization;
 - Advanced techniques for management and analysis of digital NDE data for health assessment and lifetime prediction; and
 - Biomimetic, and nano-scale sensing approaches for structural health monitoring that meet size and weight limitations for long duration space flight.

T7.02 Remote Sensors for Entry, Descent and Landing Applications

Lead Center: LaRC

Center: LaRC

The NASA Langley Research Center, located in Hampton VA, maintains core competencies in laser/lidar technology development and entry/landing/descent (EDL) applications. Innovative or improved concepts are solicited for the development of sensors supporting human and robotic exploration missions to planetary surfaces. Of immediate interest are technologies enhancing or enabling sensors used in precision guidance and navigation related to surface landings and hazard avoidance. The sensors would be employed from orbit, through descent, and during final approach. The deployed system may require multiple sensors of different fundamental types. Specific sensors/components currently of interest include those associated with:

- 3D lidar systems, including flash lidars and scanning lidars;
- High resolution radars;
- 2D optical imaging devices.

Examples of components desired would include:

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- New, highly accurate and robust wide angle scanning systems;
 - Moderate power high efficiency lasers;
 - Fast detector arrays suitable for use in coherent lidar systems;
 - High efficiency long range flash lamps.

Proposals should describe the expected improvements and advantages of proposed deliverables over existing technologies, and should estimate the effects of these improvements on the state-of-the-art EDL guidance, control and hazard avoidance capabilities. Technologies likely to be ready for flight demonstration within the next 2 or 3 years are preferred, but highly innovative longer-term concepts will also be considered.